

EXAMINATION AND SURVEY OF ARTHUR KILL, OR
STATEN ISLAND SOUND, NEW YORK AND NEW JERSEY.

L E T T E R

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, REPORTS OF
EXAMINATION AND SURVEY OF ARTHUR KILL, OR STATEN
ISLAND SOUND, NEW YORK AND NEW JERSEY.

FEBRUARY 5, 1900.—Referred to the Committee on Rivers and Harbors and ordered
to be printed.

WAR DEPARTMENT,
Washington, February 3, 1900.

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, United States Army, dated February 2, 1900, together with copies of reports from Col. J. W. Barlow, Corps of Engineers, dated May 2, 1899, and January 25, 1900, the former of a preliminary examination and the latter of a survey of Arthur Kill, or Staten Island Sound, New York and New Jersey, from Kill van Kull to Raritan Bay, made by him in compliance with the provisions of the river and harbor act of March 3, 1899.

Very respectfully,

ELIHU ROOT,
Secretary of War.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, February 2, 1900.

SIR: I have the honor to submit the accompanying copies of reports, dated May 2, 1899, and January 25, 1900, with map in three sheets, by Col. J. W. Barlow, Corps of Engineers, giving the results of pre-

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liminary examination and survey, respectively, of Arthur Kill, or Staten Island Sound, New York and New Jersey, from Kill van Kull to Raritan Bay, made under the provisions of the river and harbor act of March 3, 1899, with a view to obtaining a 21-foot channel, by way of Staten Island Sound, from New York Bay to Raritan Bay.

This waterway has been under improvement by the General Government since 1874, the present project providing for the securing of a channel 400 feet wide and 14 feet deep at mean low water.

The project now presented contemplates securing, by dredging and diking, a channel 21 feet deep from Kill van Kull to Raritan Bay, with a width of 300 feet, except at the sharpest turns, where the width is increased to 400 feet. The work proposed is estimated to cost \$696,000, and \$5,000 additional annually for maintenance.

In the opinion of Colonel Barlow the cost of the proposed improvement is reasonable when compared with the benefits to accrue and their lasting character, and he is further of opinion that the project is one worthy of being undertaken by the United States.

Very respectfully, your obedient servant.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

HON. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF ARTHUR KILL, OR STATEN ISLAND SOUND, NEW YORK AND NEW JERSEY, FROM KILL VAN KULL TO RARITAN BAY, WITH A VIEW TO OBTAINING A 21-FOOT CHANNEL, BY WAY OF STATEN ISLAND SOUND, FROM NEW YORK BAY TO RARITAN BAY.

UNITED STATES ENGINEER OFFICE,
New York City, May 2, 1899.

GENERAL: I have the honor to submit the following report of a preliminary examination of "Arthur Kill, or Staten Island Sound, from Kill van Kull to Raritan Bay, with a view to obtaining of a 21-foot channel, by way of Staten Island Sound, from New York Bay to Raritan Bay," made in compliance with section 22 of the river and harbor act of March 3, 1899, and pursuant to Department letter of April 14, 1899.

This waterway forms part of an important and much used line of communication between New York Harbor and Raritan Bay. It is also a link in the chain of inland navigation between the Passaic and Hackensack rivers through Newark Bay on the north and the Raritan River, the Delaware and Raritan Canal to Philadelphia on the south. It has been long recognized by Congress as worthy of improvement by the General Government, an aggregate of \$232,970.31 having been expended upon its improvement.

The present commerce, which is said to be increasing, amounts annually to 9,000,000 tons, consisting of oil, coal, and miscellaneous freights received from various railways: brick, clay, and fertilizers from the country adjacent to the several water courses which are its natural tributaries.

The original depth at mean low water was 15 feet and upward, except at its northern end, where it joins Newark Bay. Here a shoal,

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having a channel with but $9\frac{1}{2}$ feet depth through a tortuous channel, existed. This part of the channel has been repeatedly dredged to 14 feet, but owing to the peculiar effect of the tides, which flow in from both directions and sweep over the broad shoal area of Newark Bay to the north and west, the excavated channel soon becomes again obstructed. Several projects looking to dike protection have been considered, but with the exception of the construction of one dike on the south of the dredged channel 2,237 feet long, none of these projects have been carried out.

Navigation interests now desire that a depth of 21 feet and sufficient width for navigation be provided through the entire length of this waterway. This length is about 15 miles, of which there is now a depth of 21 feet or more for a distance of about 9 miles. The remaining distance of 6 miles will require dredging, the depth of cutting being from 0 to 7 feet. An additional dike will probably be required north of the proposed excavation at Newark Bay, and another to contract the channel at Story Flats. A low cut-off dike might be advisable behind Pralls Island.

The project as outlined is considered worthy, and to ascertain the amount and location of the dredging and dikes required a survey is recommended, at an estimated cost of \$1,500. As no complete survey of this water course has ever been made, it is desirable that the present one be carried out in considerable detail.

Very respectfully, your obedient servant,

J. W. BARLOW,

Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,

Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,

U. S. ARMY,

August 14, 1899.

Respectfully submitted to the Secretary of War.

In accordance with the provisions of the river and harbor act of March 3, 1899, a preliminary examination has been made of Arthur Kill, or Staten Island Sound, from Kill van Kull to Raritan Bay (full text of item quoted within), New York and New Jersey.

The locality is reported to be worthy of improvement, and I recommend that a survey be made and the cost of improvement be estimated.

A. MACKENZIE,

Acting Chief of Engineers.

WAR DEPARTMENT,

August 15, 1899.

Approved as recommended by the Acting Chief of Engineers.

By order of the Secretary of War:

JOHN C. SCOFIELD,

Chief Clerk.

SURVEY OF ARTHUR KILL, OR STATEN ISLAND SOUND, NEW YORK AND NEW JERSEY, FROM KILL VAN KULL TO RARITAN BAY, WITH A VIEW TO OBTAINING A 21-FOOT CHANNEL, BY WAY OF STATEN ISLAND SOUND, FROM NEW YORK BAY TO RARITAN BAY.

UNITED STATES ENGINEER OFFICE,
New York City, January 25, 1900.

GENERAL: I have the honor to submit the following report of a survey and estimate of cost of improving "Arthur Kill, or Staten Island Sound, from Kill van Kull to Raritan Bay, with a view to obtaining of a 21-foot channel, by way of Staten Island Sound, from New York Bay to Raritan Bay," made in compliance with section 22 of the river and harbor act of March 3, 1899, and pursuant to Department letter of August 11, 1899, together with a map of the survey in three sheets.

The report on the preliminary examination of this locality was submitted on May 2, 1899, to which attention is invited.

The survey was made between September 5 and October 24 by Mr. C. S. Kelsey, assistant engineer, whose report is transmitted herewith.

The project proposed for this improvement consists in securing a 21-foot channel, 300 feet wide (except at the sharpest of the turns, where it has been increased to 400 feet), from Kill van Kull to Raritan Bay. The limits of the proposed channel are shown on the maps of the survey.

This project provides a channel equal in dimensions to that now being made, and nearly attained, through Raritan Bay, which connects the southern entrance of the Arthur Kill with Lower New York Bay. The channel through Kill van Kull, which connects the northern entrance of the Arthur Kill with Upper New York Bay, has a channel depth nowhere less than 25 feet.

In addition to excavating the channel, it is proposed to construct a dike at Shooters Island so as to direct a part of the ebb from Newark Bay into the entrance of the Arthur Kill, and to cut off the cross tides over the dredged channel. This dike will be of great benefit to that section of Elizabethport directly below the railroad bridge over Newark Bay. A second dike is proposed at Story Flats, near Seawaren, to contract the cross section of the waterway, in case this is found necessary to maintain the channel depth. An estimate of cost is given at the close of this report.

The survey has afforded the following information in relation to the merits of the project. The greatest obstruction to navigation in the Arthur Kill lies directly at its entrance from the north and east. Upon the opening of the proposed channel through this entrance there would be immediately available a depth of not less than 18 feet along the entire water front of Elizabethport and Bayway, with a dock frontage, improved at the present time for a length of 13,000 feet, and occupied by coal-shipping terminals, shipyards, and great manufacturing industries.

Communication with the Arthur Kill from the south is obstructed at Story Flats, 15 miles from the southern entrance. If the proposed depth of 21 feet be secured across this shoal, the increased depth will be available without further improvement for an additional distance of 2 miles of deep-water frontage, as far as the Fresh Kills, now partially occupied by coal-shipping terminals and extensive manufactures.

Between the Fresh Kills and Pralls Island there are a number of shoals, separated by pools of deep water. The removal of each shoal, as the work progresses, will make the full depth of the project available along the property fronting the next pool above. The attainment of the entire project would be equivalent to adding 20 miles of deep-water frontage to the waters of New York Harbor, lying half within the State of New Jersey and half within the State of New York and city of Greater New York. It would give the central portion of the Arthur Kill, now comparatively cheap property, the facilities of New York Harbor water-front property, and must stimulate the growth of the present great industries and attract other works, with a corresponding increase to the taxable values of the States and municipalities in which they lie.

An additional reason for improving this important waterway is that it will afford a protected inland route from Perth Amboy and South Amboy to Upper New York Bay, thereby providing uninterrupted communication during stormy weather when the navigation of Raritan Bay and Lower New York Bay is extremely hazardous.

Under the present project, which is for a 14-foot channel, foreign commerce is excluded from the northerly 10 miles of the Arthur Kill. The coastwise traffic is excluded to an extent increasing with the present tendency to build vessels and barges of greater size and draft. A depth of 21 feet at mean low water, or about 26 feet at mean high water, would admit all but the largest of vessels.

It is believed that the proposed improvement is of a permanent nature, and will require only a small expenditure for maintenance, as there are no considerable silt-bearing tributaries, the shoals are not sedimentary deposits, and there are no shifting sand bars. These favorable conditions do not prevail at any of the improvements proposed or adopted in this district, or probably in this vicinity.

The cost of the improvement, in comparison with the benefits to accrue and their lasting character, is reasonable, and the opinion expressed in the report upon the preliminary examination, that the project was a worthy one, is adhered to after this more detailed investigation.

Estimate of cost.

To provide a channel from the Kill van Kull to Raritan Bay, 300 feet wide and 21 feet deep at mean low water:

Dredging, 3,766,150 cubic yards, at an average rate of about 14 cents...	\$523, 243
Rock removal, 24,000 cubic yards, at \$2.....	48, 000
Diking, 82,000 linear feet	55, 200
Engineering and contingencies, about 10 per cent.....	69, 557
Total	696, 000
Annual cost of maintenance	5, 000

Very respectfully, your obedient servant,

J. W. BARLOW,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. C. S. KELSEY, ASSISTANT ENGINEER.

NEW YORK, N. Y., *January 24, 1900.*

COLONEL: I have the honor to submit the following report upon a survey of the Arthur Kill, New York and New Jersey, made in compliance with your verbal orders of August 21, 1899:

A survey party was organized, sounding boat and steam launch hired, and the field work of the survey commenced September 5. An exact system of triangulation, comprising about sixty stations, was established to cover the area under survey. Half of the primary stations were referenced. The field party was provided with sketches of stations used on the United States Coast and Geodetic Survey and on the survey of the New York Harbor Line Board. Points that were identified were connected with this survey. Prominent natural objects on each shore were located. Light portable platforms were designed and employed for elevating the instrument and observer at stations on the marsh, reducing the number of observation stations required. Base lines were measured at the northern limit of the survey and midway; at the southern limit, connection was made with known points of earlier surveys. Docks and important shore line were located.

The plane of mean low water had been determined by the United States engineers, both at the northern and southern entrance to the kills. It is substantially the same plane, and was transferred to three intermediate gauges by simultaneous tidal observations, averaging the slopes of slack current occurring after both high and low water stand. The bed of the waterway was developed by over 5,000 soundings, taken mainly in cross sections. Borings were made to determine the character of the material to be excavated. The boring arrangement was designed so as to enable samples to be taken at the various penetrations obtained. It was operated by the survey party from the steam launch, using the pump of the launch to drive the jet pipe. The office work of platting and mapping, the study of a project, and the calculation of quantities and estimates, has been prosecuted as rapidly as the other duties of the office force would permit.

The map which is submitted with this report shows the line of the proposed channel from the Kill van Kull to Raritan Bay, 21 feet deep and 300 feet wide, increased to 400 feet around two sharp turns. A marked deviation from the present channel line was made between Shooters Island and Elizabethport. It is proposed to abandon the present channel at this locality, which has been under improvement by the United States, and take a more direct course south of the Corner Stake Light. The change of the direction in the present channel of about 90° within a distance of 1,000 feet is not feasible for a ship channel, and the position is most unfavorable for maintenance. The proposed line is more favorably located with reference to the underlying ledge rock and the course drift in the vicinity of the Corner Stake Light. It has advantages over a line running north of Shooters Island, both in amount of excavation, character of the material, facility to navigation, and ease of maintenance.

The length of the channel that will require dredging for the full width of 300 feet is about 6 miles. Dredging for partial widths will be required for an additional distance of 3 miles. The total amount of excavation is estimated at 3,790,150 cubic yards, based on allowance for side slopes, three horizontal to one vertical; for overdepth of one foot in dredging, and 25 per cent increase for scow measurement. In the estimate of cost the unit rates assumed were determined with due reference to class of material, depth of cutting, amount and location of the work. A dike is provided west of Shooters Island to protect the channel from the cross tides on the Newark Bay Flats. A dike is provided also to contract the cross section at Seawaren. The latter may not prove a necessity, as the deep pool through the middle of the reach is an indication that the shoals above and below the pool are not due to deposits caused by the enlarged cross section, but are a compact formation that have resisted erosion.

The estimate is based on the present system of towing dredged material to the public dumping grounds at sea. Should the Sandy Hook Light-ship be designated as the public dumping ground, as now proposed by the supervisor, it would probably result in the use of a large amount of the excavated material from the Arthur Kill in reclaiming marsh land along the shores. The estimate is believed to be ample to cover the cost of the work under these conditions. Shale rock and heavy material may be utilized in filling the dike at Shooters Island and in constructing the dike at Seawaren.

Estimate for a channel through the Arthur Kill, from Kill Van Kull to Raritan Bay, 21 feet deep at mean low water and 300 feet wide.

Dredging:

445,000 cubic yards, at 8 cents.....	\$35,600
1,333,350 cubic yards, at 12 cents	160,002
1,508,150 cubic yards, at 16 cents	241,304
479,650 cubic yards, at 18 cents.....	86,337
Rock removal, 24,000 cubic yards, at \$2.....	48,000
Diking, 82,000 linear feet	55,200
Total	626,443
Engineering and contingencies, about 10 per cent.....	69,557
Total	696,000
Annual cost of maintenance is estimated at	5,000

The physical characteristics are most favorable for maintenance, except across the Newark Bay Flats. Through the Arthur Kill proper both the ebb and flood currents are strong. The shoals are not sedimentary deposits, but glacial drift formations that have resisted erosion, while the lighter material has been scouring away and the deep pools forming between the shoals. There are no silt-bearing streams of any magnitude emptying into the kills, and no shifting sand bars. The dike proposed at Shooters Island is expected to reduce the shoaling in the channel from Shooters Island to Elizabethport to a small amount.

Respectfully submitted,

C. S. KELSEY,
Assistant Engineer.

Col. J. W. BARLOW,
Corps of Engineers.

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The Arthur Kill or Staten Island Sound

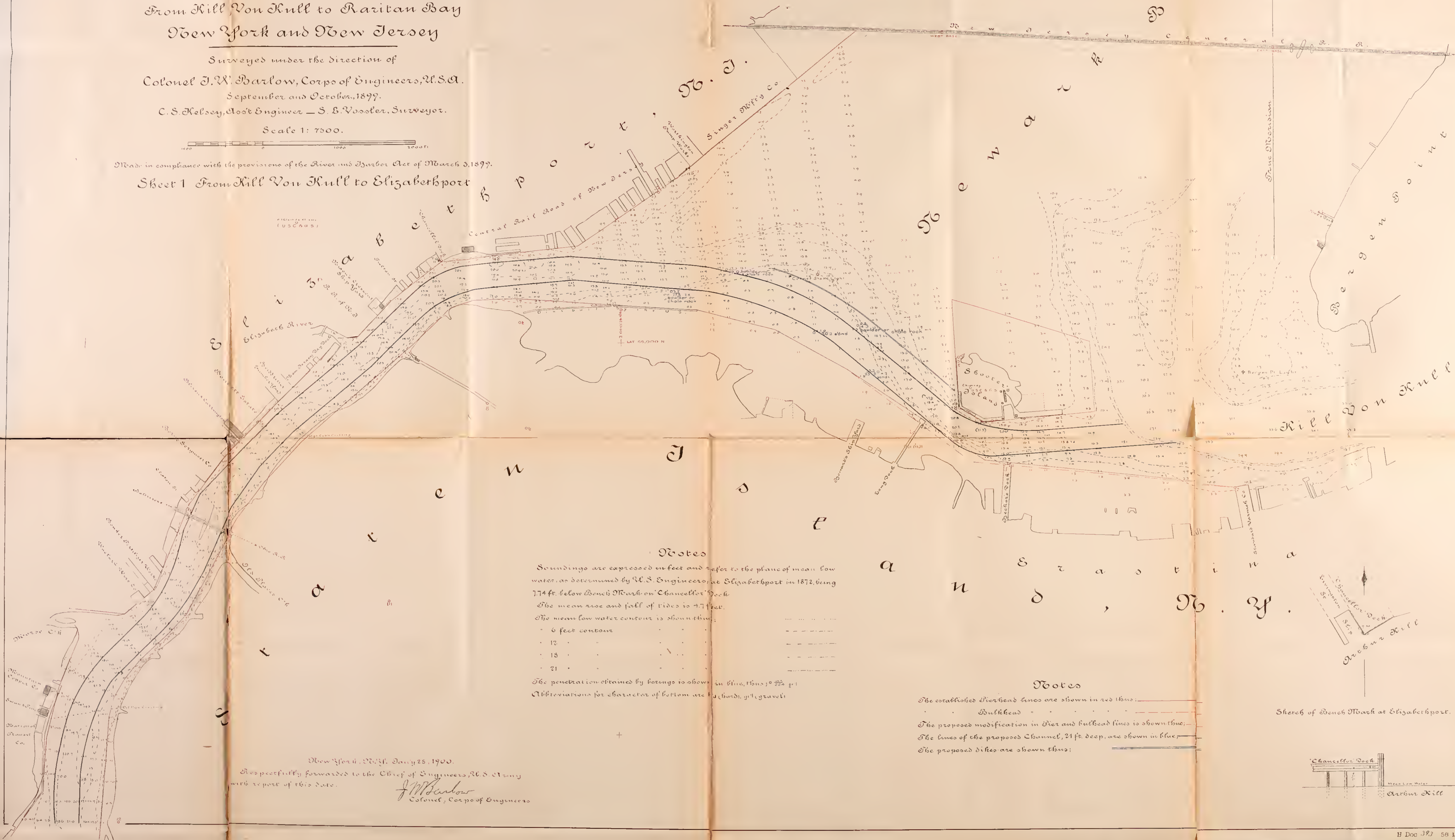
From Kill Von Kull to Raritan Bay
New York and New Jersey

Surveyed under the direction of
Colonel J. W. Barlow, Corps of Engineers, U.S.A.
September and October, 1897.
C. S. Kelsey, Asst Engineer — S. B. Vossler, Surveyor.

Scale 1: 7500.

Made in compliance with the provisions of the River and Harbor Act of March 3, 1897.

Sheet 1 From Kill Von Kull to Elizabethport



Notes

Soundings are expressed in feet and refer to the plane of mean low water, as determined by U.S. Engineers at Elizabethport in 1872, being 7.74 ft. below Bench Mark on Chancellor's Dock.
The mean rise and fall of tides is 4.7 feet.
The mean low water contour is shown thus:

- 6 feet contour
- 12 "
- 18 "
- 21 "

The penetration obtained by borings is shown in blue, thus: 20 fms. gr.
Abbreviations for character of bottom are as follows: gr. (gravel)

Notes

The established Pierhead lines are shown in red thus:

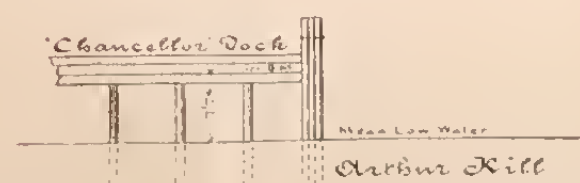
Dullhead "

The proposed modification in Pier and Bulhead lines is shown thus:

The lines of the proposed Channel, 21 ft. deep, are shown in blue.

The proposed dikes are shown thus:

Sketch of Bench Mark at Elizabethport.





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The Arthur Kill or Staten Island Sound

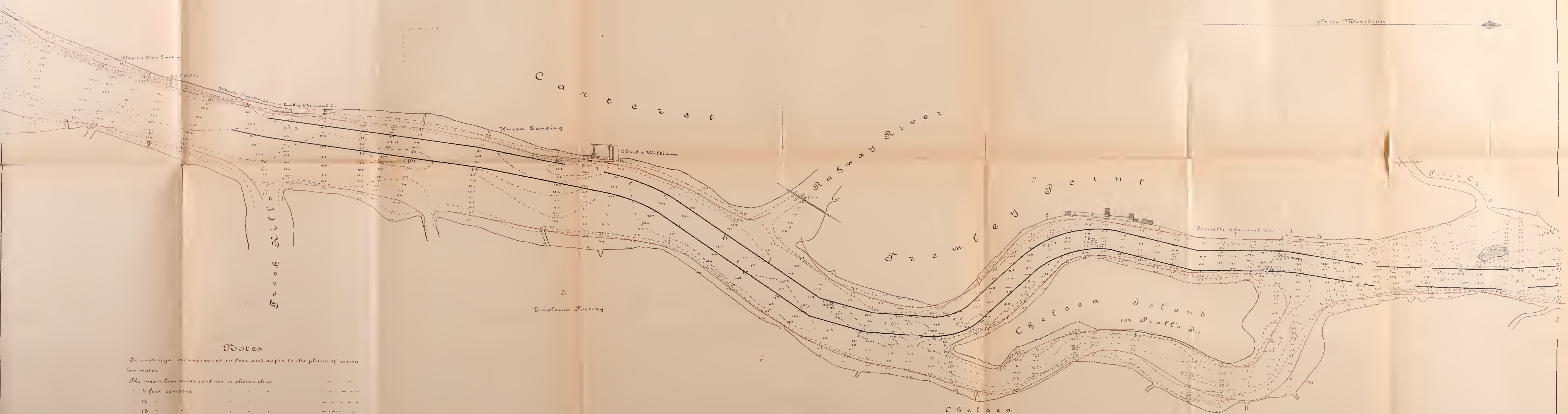
From Kill Von Kull to Raritan Bay

Scale 1: 7500.



Map in Three Sheets

Sheet 2. From Buckwheat Island to the Fresh Kills



Notes

Soundings are expressed in feet and refer to the plane of mean low water.

The mean low water contour is shown thus: ————

6 feet contour - - - - -
12 - - - - -
18 - - - - -
24 - - - - -

The penetration obtained by borings is shown in blue, thus: 0 1/2 ft. 1

Abbreviations for character of bottom are, hd, hard; g, gravel.

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